sidered to be of natural origin. Little or no notice of their contents appears to have been taken until the examination of them by Prof. Wyman, in 1860 and 1867. They are now for the most part covered by a thick forest-growth, the chief trees being oaks and palmettoes, with many shrubs and vines. The age of some of the oaks growing upon the mounds has been estimated by their annual rings at 400 years, and one, a gigantic one, at 666 years. Taking this into consideration, together with the changes in the channel of the river, the formation of new land, and the extension of plants and trees over it, Prof. Wyman thinks that an antiquity of a thousand years would not be an unreasonable age to allow for the earliest shell-mounds.

OUR ASTRONOMICAL COLUMN

THE VARIABLE STAR 34 CYGNI, NOVA 1600.—This star, although an object of pretty frequent meridian observation, has probably received less attention than most others from those observers who especially occupy themselves with the variable stars, owing to the circumstance of the estimates of magnitude recorded at transit having been remarkably accordant for upwards of a century. Indeed since the year 1750, on examining the catalogues, we find in the majority of cases that the star is estimated $5\frac{1}{2}$, the only marked exception being Bessel's observation in his zone 1825, September 14, when it is called 6·7.

If, however, we examine the earlier history of this star, we see there are some grounds for suspecting that one or more maxima may have escaped observation, unless the irregularity of variation attributed to it, in the recent catalogues of such objects be very great.

The discovery of the star is ascribed to William Janson, who had marked it on a celestial globe in 1600, as we learn from Kepler ("De Stellâ tertii honoris in Cygno," appended to his well-known work, "De Stellâ novâ in pede Serpentarii," which appeared in 1606). Kepler himself was not aware of its existence till May, 1602, and he enters into an explanation which is, to an extent, apologetical, for his not having previously remarked it. At the same time he calls it a *new* star, and in proof of its being so, adduces, in addition to Janson, the authority of Justin Byrgius and Bayer, who, by the way, has attached the letter P to the star in his "Uranometria," and is followed by Prof. Schönfeld. By observations in August, 1602, he fixed its position in R.A. 300° 46′, Decl. 36° 52′, which agrees closely with the modern catalogues. He calls it a third magnitude in 1602, and states that it continued of the same brightness during the nineteen years over which his observations extended; it was not quite so bright as γ Cygni, but was brighter than β in the same constellation.

According to Liceti it appeared again in 1621, afterwards diminishing, until lost altogether. In 1655 it was observed again by Dominique Cassini, and gradually brightened during five years, until it attained the third magnitude, and subsequently diminished. Hevelius states that it reappeared in November, 1655; it was still very small in 1666, afterwards becoming brighter, though without reaching the third magnitude. In 1677, 1682, and in 1715 it was estimated a sixth magnitude, and there is no further record of its increase to the maximum of 1602.

Pigott assigned a period of eighteen years, which but imperfectly represents the observations of the seventeenth century.

Schönfeld remarks that it is doubtful whether the star had its actual brightness before the year 1600, or was invisible; perhaps the former condition will be considered the more probable, notwithstanding Kepler's account of its having escaped his observation from the year 1591, when he commenced the study of the heavens under Mæstlin, and noted but one conspicuous star in the breast of the Swan.

Probably a systematic observation of 34 Cygni may lead to the record of another maximum. The star is of a deep yellow colour, and its position for the beginning of 1877 is in R.A. 20h. 13m. 15s., N.P.D. 52° 21′.

Its neighbour χ (Bayer) Cygni, deserves special attention at present, the fluctuations of brightness for some years past having been quite exceptional. Its position is in R.A. 19h. 45m. 50s., N.P.D. 57° 23′ for 1877·0.

THE INTRA-MERCURIAL PLANET QUESTION.—M. Leverrier made a further communication to the Paris Academy, on the 2nd inst., with reference to this subject. Having collected in his previous communications, chiefly from the original authorities, such observations as could be supposed to bear upon it in any way, he finally selects for discussion those only which, in addition to the roundness and blackness of the spots, have distinct mention of sensible change of position upon the sun's disk on the day of observation. There are ten cases under this head in the months of January, February, March, May, and June, or possibly beginning of July, and October. M. Leverrier remarks it is inadmissible that a body projected upon the sun on February 12, which is the date of the observation by Steinheibel mentioned in the correspondence between Olbers and Bessel, could repass at the end of March or beginning of October, *i.e.*, when arriving in the line of nodes of the objects seen by Lescarbault and Lummis. This could only happen if the first body moved in an orbit very little inclined to the ecliptic, but in this case the necessary frequency of the transits must have led to its being more often observed. For the present, therefore, he confines himself to treating five observations in October and March, where motion like that of a planet in transit are recorded. His data stand thus:—

Decuppis,	1839, Oct. 2·0	Helioc. long.,	8°·60
Fritsch,	1802, Oct. 10·0	,,	16·46
Sidebotham,	1849, March 12·18	,,	172·01
Lummis,	1862, March 19·87	,,	179·86
Lescarbault,	1859, March 26·22	,,	186·60

And it is found that these five longitudes are represented with all the precision permitted by the nature of the observations by the formula (ν = helioc. longitude)—

$$\nu = 121°{\cdot}49 + 10°{\cdot}9017834\, j - 0°{\cdot}52 \cos. \nu,$$

j being reckoned in days from 1750·0.

The differences between calculation and observation are:—

1839	...	+ 3°·6	1849	...	+ 3°·5
1802	...	− 3·6	1862	...	+ 0·8
			1859	...	− 4·6

None of the residuals exceeding a half-day's motion, M. Leverrier thinks it permissible to infer that the five observations appertain to the transits of the same body.

With the above motion the period of revolution is 33·0225 days, and the semi-axis major 0·201.

The existence of an intra-Mercurial body announced by theory, being, according to M. Leverrier, beyond doubt; to use his own words, "nous voilà desormais en possession de données permettant dès à present de constituer une première théorie qui conduira à retrouver la planète avec facilité et à la faire rentrer dans le système régulier des corps célestes." In conclusion he states that he is now occupied in determining the epochs of the next following transits over the sun's disk.

NOTE ON THE SUN-SPOT OF APRIL 4, 1876

(Communicated by the Astronomer Royal)

ON the publication of Herr Weber's observation of a round spot seen on the sun on April 4, reference was made to the photographs taken at the Royal Observatory, Greenwich, on the morning of that day, and it was remarked at once that there was a small round spot

in a group of faculæ near the north-east limb in the place indicated by Herr Weber's observation. The position of the spot has now been measured on the two photographs, which were taken at 21h. 46m. 35s. and 22h. 1m. 4s. Greenwich mean time respectively, and the following are the means of the two sets of results which agree very closely :—

1876, April 3d, 21h. 54m.

Distance from sun's centre along arc of parallel	788″
Diff. of R.A. (Spot − ⊙)	+ 52ˢ·3
Diff. of N.P.D. (Spot − ⊙)	− 218″·5
Distance from sun's centre	817″
Distance from N.E. limb	145″
Diameter of spot	4″

As Herr Weber's observation was made at 4h. 25m. Berlin mean time, or 3h. 31m. Greenwich mean time, the sun's rotation in the interval—5h. 37m.—would have carried the spot to a distance of about 163″ from the limb, as appears from a rough computation, and thus the position would agree tolerably well with that given by Herr Weber. There can be no question that the spot on the Greenwich photographs, which is the same as that observed by M. Ventosa, is an ordinary sun-spot without penumbra, and not an intra-mercurial planet.

Royal Observatory, Greenwich, October 4

CAUTIONS AS TO INTRA-MERCURIAL OBSERVATIONS

AT the Paris Academy on the 2nd instant, Dr. Janssen read a paper containing some very timely cautions as to the observation of the transit of intra-Mercurial bodies across the sun. He maintains that we have the means of investigating the problem which at present is interesting astronomers of a most satisfactory kind and leading to a certain and rational result. The first of these means is the knowledge we now possess of the solar envelope, and the second is photography. A criterion of a true transit is that the spot be well rounded against the solar disc, that it have a rapid displacement on the surface of the disc, a motion quite different from the apparent motion of solar spots. These requirements would eliminate a great number of doubtful observations, and even then the transit might not be a real one. Many solar spots are distinctly rounded, but then error is apt to creep in in the observation of the proper movement, especially when the observation is made with a telescope having no equatorial mounting, the diurnal motion making the spot appear to be constantly changing place. The rapid disappearance of a spot is no proof that it is outside the sun ; at the minimum period spots have a tendency to dissolve rapidly. It follows that the isolated observations made by persons who have no thorough knowledge, or who have not suitable instruments, are comparatively valueless. While giving the highest place to photography, Dr. Janssen thinks telescopic observations of so great importance that he gives some hints for the guidance of observers.

There are circumstances connected with the constitution of the photosphere which may afford guidance even in fugitive observations. Briefly, as a solar spot is a phenomenon of the photosphere, a disturbing phenomenon at the highest point of the region where it is produced, it follows that the ordinary aspect of the photosphere is modified all round it. Moreover, if the spot is sufficiently distant from the centre of the disc, it ought to present the perspective effects of an object placed upon the vanishing surface of a globe. Finally the region of the sun where the spot appears ought to be attended to, to discover its solar latitude, since we know that the spots are located in two main regions, to the north and to the south of the sun's equator. More valuable still is the following test. It is evident that a moving body interposed between our eye and the solar surface ought to produce a succession of eclipses of the granulations covering that surface ; to cover successively those towards which it moves and uncover those on the opposite side. This phenomenon of emersion and immersion is the most decisive of all tests of the value of a brief observation ; it requires, however, a good instrument of considerable power. Dr. Janssen advises moreover that the regions around the sun's disc to three or four minutes angular distance should be explored with the greatest care ; as at that distance the coronal atmosphere is bright enough for a body of a fraction of a minute in diameter to give a visible eclipse. A trustworthy observation of a body seen either entering or leaving the sun's disc under such circumstances, is of the very highest value ; moreover the field of observation is thus greatly increased. But eye observations of the sun must at best be but isolated, and photography furnishes the only sure method of unerring, precise, authentic observation, surpassing in value that of the ablest astronomer.

The question of intra-Mercurial bodies shows once more the immense importance of obtaining uninterrupted international observation of the sun's face. Hence the value of a mechanical photographic revolver that would, every hour, say, photograph the sun, without requiring the interference of any one. A number of these distributed over the globe would, in a few years, give us such a knowledge of the sun's surface as it would be impossible to obtain under any other circumstances.

RUSSIAN EXPLORATION IN ASIA DURING THE PAST SUMMER

THE following information as to the different scientific expeditions sent during the past summer by the Russian learned societies for the exploration of various parts of Russia and of the adjacent territories will probably be of interest. We begin with Central Asia, leaving for another paper the report upon the proceedings of the expeditions to the Obi and Jenissei.

M. Prshevalsky has left Omsk, and we have already given some account of the scientific staff of the expedition and the route he proposes to follow.

M. Severtsoff, as reported by the *Turkestanskija Vedomosti*, was to begin his travels in the Fergana district and in the adjoining hilly tracts during this autumn. He will be accompanied by M. Sharz, astronomer, M. Mushketoff, mining engineer, M. Smirnoff, botanist, M. Skvortsoff, zoologist, one topographer, and six Cossacks. During next summer he proposes to explore the Alai and the mountains south of Kokan, and to penetrate about the autumn into the Pamir, reaching here the route followed by the members of Mr. Forsyth's expedition.

M. Potanin, as reported by the *Sibir*, reached Omsk on June 27. The object of his expedition is the geographical, ethnographical, and economical exploration of North-western Mongolia, for which purpose 9,400 roubles were allowed by the Geographical Society and by the Government. He will be accompanied by his wife, M. Posdnéeff, linguist, M. Raphailoff, topographer, M. Beresoffsky, volunteer, and M. Kolomiitseff, zoologist, sent by M. Severtsoff. Starting from the Zaisansky post on the Irtish, M. Potanin will follow the steppe-valley of the Black Irtish and proceed to Urumga, Khobdo, the Oobsa-nor. For winter-quarters he will then go south, through Oolassootai to the eastern parts of the Tian Shan. During the following summer, taking a northern course, the expedition proposes to reach the sources of the Jenissei and the Kossogol lake, returning south again for the winter to the eastern foot of the Shangai-alin and to the expansion of the Onguiin river. During his stay in Omsk, M. Posdnéeff has assiduously visited the town's archives, and has found some very interesting documents; for instance, letters from the Telengoot chiefs written in Kalmuck with Mongolian alphabet, whilst now the Telengoots do not use any written language.